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(54) **Title of the Invention.** A solidification material capable of preventing dispersal

(57) **Abstract**

Objective. To provide a solidification material for the purpose of preventing the dispersal of cement as dust.

Composition. The solidification material of the present invention comprises an alcohol or ether compound or a mixture of these compounds with liquid paraffin mixed into a main ingredient. Cement, slaked lime, caustic lime and the like are used as the main ingredient. An alcohol or ether compound is used as the anti-dispersal ingredient; examples include ethylene glycol, diethylene glycol, propylene glycol, ethylene glycol dimethyl ether, glycerin and liquid paraffin, and they may be used singly or a combination of two or more may be used. The amount added of this alcohol or ether compound[s] is from 1% to 5% of the main ingredient, and that of liquid paraffin, from 1% to 5% of the main ingredient. In addition, the ratio of alcohol or ether compound[s] to liquid paraffin mixed together is from 1:3 to 3:1.

Scope of the Claims

Claim 1 A solidification material capable of preventing dispersal of dust, characterized in that at least one alcohol or ether compound is mixed into the main ingredient as the anti-dispersal ingredient.

Claim 2 A solidification material capable of preventing dispersal of dust claimed in Claim 1, characterized in that the anti-dispersal ingredient is a mixture of at least one glycol, glycerin or ether compound and liquid paraffin.

Detailed Description of the Invention

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Field of Use in the Industry The present invention concerns a solidification material capable of preventing dispersal of dust, and more specifically concerns a solidification material capable of preventing dispersal of dust that contains a mixture of at least one glycol, glycerin or ether compound and liquid paraffin as the anti-dispersal ingredient.

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Previous Technology When ground improvement construction is carried out for roads and the like, asphalt paving is carried out after the road is dug up and the ground leveled, but when the road is dug up or the ground is leveled, it often happens that cement disperses [into the air] as dust and there are complaints from residential areas.

0003 Because of this, in locations bordering on shopping districts and homes, and even more particularly when the wind is strong, as in winter, road construction companies take a number of dust [suppression] measures. For example, when construction is carried out in locations bordering on shopping districts and homes, dust [suppression] measures such as covering the construction area with tarpaulins to prevent dust from dispersing and putting the construction on hold when the wind is strong have been tried.

0004 In addition, fibers have been added to cement to prevent the cement from blowing up into the air as dust, and in recent years, polytetrafluoroethylene has been developed as a soil improving material, and it has been mixed together with the cement, for example, that is the main ingredient to form solidification materials. The use of these solidification materials mixed with the soil produced at the construction site gives the excellent result that the production of dust is suppressed extremely well.

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Problems the Invention Attempts to Solve However, the dust prevention effect on dust with previous fiber-added cements has not been adequate, and while, as described above, the effectiveness of solidification materials containing polytetrafluoroethylene is excellent, economically, they have the disadvantage of being expensive.

0006 Accordingly, the inventors of the present invention, to find a soil improver that is both effective in preventing dispersal of dust and can be obtained cheaply, tested and examined a variety of compounds and as a result discovered the fact that alcohol compounds, particularly glycol compounds, ether compounds and liquid paraffin are effective, and this led to the present invention. Consequently, the objective of the present invention is to provide a solidification material for the purpose of preventing the dispersal of cement as dust.

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Measures by which the Problems are Resolved The above objective of the present invention is attained by means of a solidification material capable of preventing dispersal of dust, characterized in that an alcohol or ether compound is mixed into the main ingredient. In addition, it is attained by means of the aforementioned solidification material capable of preventing dispersal of dust, characterized in that the anti-dispersal ingredient is a mixture of at least one glycol, glycerin or ether compound and liquid paraffin.

0008 In the explanation of the present invention in detail below, cement, slaked lime, caustic lime and the like can be used as the main ingredient. For the anti-dispersal ingredient used in the present invention, an alcohol compound, an ether compound or liquid paraffin can be used. Examples of alcohol compounds and ether compounds include ethylene glycol, diethylene glycol, propylene glycol, triethylene glycol, ethylene glycol dimethyl ether and glycerin, and these may be used singly or a combination of two or more may be used.

0009 The amount added of this alcohol or ether compound[s] is from 1% to 5% of the main ingredient. In addition, the liquid paraffin is a relatively light lubricating oil fraction, for example, spindle oil fraction, preferably a highly refined hydrocarbon oil, and comprises mainly alkyl naphthenes. The amount added of liquid paraffin is from 1% to 5% of the main ingredient. Furthermore, even more effective prevention of dust dispersal can be obtained when a glycol compound and liquid paraffin are used mixed together, and this is when they are mixed together in a ratio of from 1:3 to 3:1, preferably 3:1.

0010 In addition, the solidification material capable of preventing dispersal of dust may be [prepared] by adding the alcohol or ether compound[s] and mixing them into the main ingredient in advance, or by adding the alcohol or ether compound[s] to the main ingredients to form a solidification material when it is used on site, but the former, in which the alcohol or ether compounds are added and mixed into the main ingredient in advance, is preferred. These methods are also applicable in the case of mixtures of an alcohol or ether compound with liquid paraffin.

0011 The solidification material capable of preventing dispersal of dust of the present invention is normally mixed with soil produced from the site to improve the roadbed and to prevent dust from dispersing when paving roads. However, it should not even be necessary to state that its application is not limited to this, and it can also be used in other similar applications.

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Working Examples The present invention is described more specifically below using working examples, but the present invention is not limited by these working examples.

0013 Working Example 1

Using Stabilite M15 (Mitsubishi Materials Corp., a cement-based solidification material) as the solidification material, alcohol and ether compounds were added by spraying it on to the Stabilite M15 in weight ratios of 1%, 2% and 3% respectively, and mixed to sufficient uniformity with a mixer to make solidification materials for the samples. Next, the water content per unit volume and particle size distribution of the soil samples used were measured, and [these] are shown in Table 1.

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Table 1

No.	Sample	Water content (%)	Weight / unit volume (g/cm^3)	Particle size distribution		
				Gravel	Sand	Fine particles
1	Loam	116.5	1.349	0	6.4	93.6
2	Sandy silt	25.8	1.896	3.4	64.4	32.2

0015 Single-axis compression tests were carried out using soil samples having the soil test results shown in Table 1. The method for the single-axis compression tests was: each solidification material was added in a specified amount to the soil sample and thoroughly mixed with a Hobart type soil mixer, and then the soil samples were tamped down to make test materials for the single-axis compression tests. After aging and curing for specified times, single-axis compression strength was measured. The results obtained are shown in Table 2.

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Table 2

Sample soil	Solidification material		Amount added (kg/m^3)	Single-axis compression strength (kgf/cm^2)		
				Aged 3 days	Aged 7 days	Aged 28 days
Kanto loam	Stabilite M15		200	5.21	6.49	7.58
	Ethylene glycol dimethyl ether	1%	200	4.60	5.23	6.15
		2%	200	4.54	5.15	5.84
		3%	200	4.14	4.75	5.64
	Diethylene glycol	1%	200	4.82	5.45	6.13
		2%	200	4.48	4.90	6.03
		3%	200	4.36	4.79	5.76
	Glycerin	1%	200	4.86	5.49	6.31
		2%	200	4.62	5.27	6.22

		3%	200	4.30	4.74	5.46
Sandy silt	Stabilite M15		100	10.35	12.39	14.17
	Ethylene glycol dimethyl ether	1%	100	10.13	11.15	12.58
		2%	100	8.86	10.21	11.82
		3%	100	8.54	9.36	10.39
	Diethylene glycol	1%	100	9.14	11.07	11.92
		2%	100	9.10	10.03	11.89
		3%	100	9.06	9.99	11.62

0017 As is clear from Table 2, it can be seen that even when the alcohol or ether compounds used in the present invention are added, the strength of the solidification material does not change substantially, or increases with the number of days aged.

0018 Next, using Stabilite, [samples] with the alcohol or ether compounds used in the present invention added and [samples] to which they were not added were prepared. 350 g of the solidification material test samples were mixed at a high speed for 1 minute using a mortar mixer to forcibly produce dust, and after mixing, the remaining sample was weighed to determine the amount of dust produced. The results obtained are shown in Table 3.

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Table 3

Solidification material	Additive	Percent added (%)	Weight before mixing (g)	Weight after mixing (g)	Amount of dust produced (%)
Stabilite M15	–	–	350.0	347.2	100
	Ethylene glycol dimethyl ether	1	350.0	349.3	25
		2	350.0	349.5	18
		3	350.0	349.3	25
	Diethylene glycol	1	350.0	349.5	18
		2	350.0	349.7	11
		3	350.0	350.0	0
	Glycerin	1	350.0	349.1	32
		2	350.0	349.4	21
		3	350.0	349.6	14

0020 As is clear from Table 3, taking the amount of dust produced by the comparison [sample], which is the solidification material to which no additives were added, as 100%, it can be seen that the amount of dust produced was low for all the [samples] with the additives of the present invention added. Furthermore, shallow layer improvement for a road was carried out in a

residential area with the solidification material of the present invention, and it was a good solidification material, producing no dust when the cement was sprayed and mixed.

0021 Working Example 2

Using Stabilite M15 (Mitsubishi Materials Corp., a cement-based solidification material) as the solidification material, diethylene glycol and liquid paraffin were added in a weight ratio of 2% by spraying it on to the Stabilite M15, and mixed to sufficient uniformity with a mixer to make solidification materials for the samples. In this case, the tests were carried out with diethylene glycol and liquid paraffin in the four ratios shown in Table 5. Next, the water content per unit volume and particle size distribution of the soil samples used were measured, and [these] are shown in Table 4.

0022

Table 4

No.	Soil sample	Natural water content (%)	Weight / unit volume (g/cm^3)	Particle size distribution (%)		
				Gravel	Sand	Fine particles
1	Kanto loam	115.2	1.359	0.2	7.0	92.8
2	Sandy silt	39.5	1.761	0.6	38.8	60.6

0023 Single-axis compression tests were carried out using soil samples having the soil test results shown in Table 4. The method for the single-axis compression tests was: each solidification material was added in a specified amount to the soil samples and thoroughly mixed with a Hobart type soil mixer, and then the soil samples were tamped down to make test materials for the single-axis compression tests. After aging and curing for specified times, single-axis compression strength was measured. The results obtained are shown in Table 5.

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Table 5

No.	Soil sample	Solidification material	Amount of solidification material added (kg/m^3)	Percent additive added (%)	Additive ratios (%)		Single-axis compression strength (kgf/cm^2)			Relative strength (%)		
					Diethylene glycol	Liquid paraffin	Aged 3 days	Aged 7 days	Aged 28 days	Aged 3 days	Aged 7 days	Aged 28 days
1	Kanto loam	Stabilite M15	150	–	–	–	4.21	4.67	5.33	100	100	100
2			150	2	100	–	3.70	4.17	4.69	88	89	88
3			150	2	–	100	4.09	4.45	5.13	97	95	96
4			150	2	75	25	4.02	4.49	5.08	95	95	95
5	Sandy silt	Stabilite M15	80	–	–	–	14.75	18.17	22.0	100	100	100
6			80	2	100	–	12.83	16.43	20.29	87	90	92
7			80	2	–	100	15.10	18.37	22.59	102	101	103
8			80	2	75	25	14.51	17.66	22.06	98	97	100

0025 As is clear from Table 5, it can be seen that even when the diethylene glycol and liquid paraffin used in the present invention are added in a ratio of 75:25, the strength of the solidification material at 28 days of aging decreases only slightly and their use causes no problems. Next, using Stabilite M15, [samples] were prepared with the diethylene glycol and liquid paraffin used in the present invention added in the proportions shown in Table 6, dust production tests were carried out as follows, and the results obtained are shown in Table 6.

0026 Dust production tests 350 g of the solidification material test samples were mixed at a high speed for 1 minute using a mortar mixer to forcibly produce dust, and after mixing, the remaining sample was weighed to determine the amount of dust produced.

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Table 6

No.	Solidification material	Percent of additive added (%)	Additive ratios (%)		Weight before mixing (g)	Weight after mixing (g)	Amount of dust produced (%)
			Diethylene glycol	Liquid paraffin			
1	Stabilite M15	–	–	–	350.0	347.62	100
2		2	100	–	350.0	349.69	13
3		2	–	100	350.0	349.73	11
4		2	75	25	350.0	349.95	2
5		2	50	50	350.0	349.89	5
6		2	25	75	350.0	349.84	7

0028 As is clear from Table 6, taking the amount of dust produced by the comparison [sample], which is the solidification material to which no additives were added, as 100%, it can be seen that the amount of dust produced was low for all the [samples] with the additives of the present invention added. That is, the amount of dust was low: 13% with diethylene glycol added, 11% with liquid paraffin added and from 2% to 7% with diethylene glycol and liquid paraffin added. It can be seen that in particular, when the ratio of diethylene glycol to liquid paraffin is 25:75, the amount of dust produced is even lower, at 2%. Next, shallow layer improvement for a road was carried out in a residential area with the solidification material of the present invention, and it was a good solidification material, producing no dust when the cement was sprayed and mixed.

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Effectiveness of the invention The present invention makes it possible to obtain a solidification material containing alcohol (particularly glycol) compounds, ether compounds, (particularly glycol compounds) or compounds obtained by means of combining ether compounds and liquid paraffin, namely, a low dust solidification material; and the use of this [material] has an excellent effect in preventing dispersal of dust in construction such as road paving.

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